

Claims

1. An overwound munitions casing incorporating an annulus of a shape memory alloy which has been subjected to a combination of mechanical and thermal treatments and which has a composition such that upon subsequent heating to a predetermined temperature, said annulus will contract radially inwardly and rupture the said munitions casing.
2. A casing as claimed in claim 1 wherein the annulus is comprised of a solid ring of shape memory alloy.
3. A casing as claimed in claim 1 wherein the annulus is comprised of a plurality of windings of shape memory alloy in wire form.
4. A casing as claimed in any one of the preceding claims, wherein the shape memory alloy to form the annulus is stretched or expanded at a temperature below the predetermined temperature prior to fitting on the munitions casing.
5. A casing as claimed in any one of the preceding claims, wherein the shape memory alloy is selected from Cu-Al-Zn, Cu-Al-Ni, Cu-Ni-Al-Zn-Mn, Cu-Zn-Al-Mn and Ti-Ni alloys.
6. A casing as claimed in any one of the preceding claims, wherein a cutting means is located between the annulus and the casing and is arranged, such that in use, the radially inward force exerted by the annulus is concentrated onto a relatively small area of the munitions casing.
7. A casing as claimed in claim 6, wherein the cutting means may be selected from a spike, blade or sharp edge.
8. A casing as claimed in claim 6 or claim 7 wherein the cutting means is retained in a retracted position prior to use, such that it is not in direct contact with said casing.

9. A casing as claimed in claim 8 wherein the cutting means is retained in the retracted position by means of a sacrificial spacer, a bias means, sacrificial retaining pins or a shearable adhesive bond.
10. A casing as claimed in any one of the preceding claims, wherein heating of the annulus is afforded by an external heating means or an internal heating means.
11. A casing as claimed in claim 10, wherein the internal heating is afforded by resistive ohmic heating of the annulus, by direct application of a current or by inductive heating.
12. A casing as claimed in any one of the preceding claims wherein the annulus is a wire winding and is wound within a housing which is located around the casing.
13. A casing as claimed in claim 12 wherein the housing extends substantially wholly or partially around the perimeter of the munition casing.
14. A casing as claimed in either claim 12 or claim 13, wherein the housing is U-shaped or rectangular in cross section.
15. A casing as claimed in claim 14, wherein part of the length of the housing is provided with a flange which extends laterally on each side of the base of the housing.
16. A casing as claimed in any one of claims 12 to 15 wherein the walls of the housing are cut to provide reduced flexural stiffness.
17. A method of rupturing a munitions case comprising locating at least one annulus as described in any one of claims 1 to 16, around the outer surface of a munitions casing, causing an external or internal heating means to be applied to said at least one annulus, wherein the at least one annulus is caused to rupture the munitions casing.

18. A connection means for joining together separate components to form a unified munitions casing for containment of an energetic material, wherein locking engagement can be provided between an integral operative part of said connection means and an integral co-operative part of at least one of said components wherein either or both of the operative and co-operative parts is or are made of a shape memory alloy which occupies a first configuration at a first temperature and undergoes a change of shape when brought to a second temperature, to afford a second configuration, said operative and co-operative parts providing locking engagement at the first temperature and allowing release from said locking engagement at the second temperature, wherein the second temperature is greater than the first temperature but is lower than the temperature of ignition of the energetic material.
19. A connection means as claimed in claim 18, wherein the operative and co-operative parts respectively comprise either one or more projections and one or more complementary recesses.
20. A connection means as claimed in claim 19, wherein said one or more projections comprises at least one tongue, lug, latch, bolt, wedge, pin, lip, male threaded portion or any other form of protrusion which will form a locking engagement with a complementary recess.
21. A connection means as claimed in claim 20, wherein said one or more complementary recesses comprises a pocket, groove, channel or female threaded portion.
22. A connection means as claimed in claim 21, wherein the operative and co-operative parts possess complementary threads.
23. A connection means for joining together separate components to form a unified body wherein locking engagement can be provided between an integral operative part of said connection means and an integral co-operative part of at least one of said components wherein either or both of the operative and co-operative parts is or are made of a shape memory alloy which occupies a first configuration at a first

temperature and undergoes a change of shape when brought to a second temperature, to afford a second configuration, said operative and co-operative parts providing locking engagement at the first temperature and allowing release from said locking engagement at the second temperature, wherein the operative and co-operative parts are provided with complementary threads.

24. A connection means as claimed in any one of claims 18 to 23, which is separate from the two components.
25. A connection means as claimed in claim 24, which forms a structural and load bearing joint between the two components when in locking engagement therewith.
26. A connection means as claimed in any one of claims 18 to 23, wherein each of the operative and co-operative parts is integral with one of the two components.
27. A connection means as claimed in any of claims 18 to 26, wherein only the operative part of said connection means is made of a shape memory alloy.
28. A connection means as claimed in any of claims 18 to 26, wherein both the operative and the co-operative parts are comprised wholly or partially of a shape memory alloy.
29. A connection means as claimed in any of claims 18 to 28, wherein the second configuration is expanded with respect to the first configuration.
30. A connection means as claimed in any of claims 18 to 28, wherein the second configuration is contracted with respect to the first configuration.
31. A connection means as claimed in claim 28, wherein either the operative or co-operative parts will be expanded in its second configuration and the co-operative and operative parts respectively will be contracted in its second configuration.

32. A connection means as claimed in any of claims 18 to 31, wherein said connection means reversibly joins the two components, such that the original components and connection means can be recovered.
33. A connection means as claimed in any one of the preceding claims 23 to 32, wherein the unified body forms a munitions casing for containment of an energetic material.
34. A connection means as claimed in any of claims 18 to 22 or claim 33, wherein the connection means has a second temperature greater than the first temperature but which is lower than the temperature of ignition of the energetic material.
35. A connection means as claimed in either claim 33 or claim 34 wherein the munitions casing is a bomb, shell, torpedo, missile or rocket motor casing.
36. A connection means as claimed in claim 35, wherein the munitions casing is a rocket motor casing.
37. A connection means as claimed in any of claims 33 to 36, wherein the shape metal alloy has a transition temperature range which lies in the range of 80°C -150°C.
38. A connection means as claimed in any of claims 14 to 37, wherein the shape metal alloy is selected from Cu-Al-Zn, Cu-Al-Ni, Cu-Ni-Al-Zn-Mn, Cu-Zn-Al-Mn and Ti-Ni alloys.
39. A connection means as claimed in any of claims 18 to 38, wherein the shape metal alloy has an expansion/contraction strain of at least 1%,
40. A connection means as claimed in claim 39, wherein the shape metal alloy has an expansion/contraction strain of at least 2%.
41. A munitions casing comprised of at least two parts connected together by a connection means as claimed in any of claims 18 to 22 or claim 33 when dependent thereon.

42. A munitions casing as claimed in claim 41 which is a casing for a shell, bomb, torpedo, missile or rocket motor.
43. A munitions casing as claimed in claim 42 which is a rocket motor casing or missile casing.
44. A munition comprising a munitions casing as claimed in any of claims 41 to 43 and containing an energetic material.
45. A munition as claimed in claim 44 and comprising a motor unit for a rocket or missile, wherein the energetic material is a propellant.
46. A munition as claimed in claim 44 and comprising a shell or bomb wherein the energetic material is a high explosive.
47. A connection means substantially as herein described and with reference to the accompanying drawings.
48. A munitions casing substantially as herein described and with reference to the accompanying drawings.